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4 NOV 1965

*Meeting - 1*

**MEMORANDUM FOR: Director of Central Intelligence**

**THROUGH: Deputy Director for Science and Technology**

**SUBJECT: First International Water Desalination  
Symposium and Exposition, 3-9 October 1965,  
Washington, D. C.**

1. This memorandum is for information only.
2. The United States Government, as host to the subject Symposium, extended to all governments with which it maintains diplomatic relations invitations to send official delegations to the meeting. Sixty-five countries were represented at the sessions. The Departments of State and Interior were in charge of the administrative and substantive activities respectively.
3. The Symposium and attendant Exposition focused world-wide attention on desalting, its status at the present time, current research and development efforts and future plans. Information of this type is necessary if desalination is to have a wide-spread role in alleviating the world-wide water problem.
4. The U. S. and USSR are both active in practically all of the known desalination methods with the U. S. at a more advanced stage in almost every instance. One exception to this is the application of nuclear reactors to desalination as a source of heat or electricity. The Soviets are building a nuclear-powered unit to provide 30 million gallons of desalted water per day. Also the Soviets have many small desalination units scattered throughout the country using solar heat, the ion exchange method and electro-dialysis.

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5. The attached Appendix gives a more detailed coverage of  
the Desalination Symposium.



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**DONALD F. CHAMBERLAIN**  
Director of Scientific Intelligence

**Attachment:**  
**Appendix**

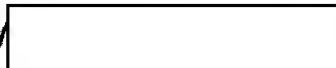
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# **APPENDIX**

## **Report of the First International Desalination Symposium and Exposition**

1. The subject meeting was truly international in character. The approximately 2,000 attendees represented sixty-five countries and the following international groups -- Euratom, International Atomic Energy Agency, International Bank for Reconstruction and Development, United Nations, United Nations Educational, Scientific and Cultural Organization and the U. N. Food and Agriculture Organization. The Soviet-Bloc representation was one attendee from Bulgaria and Poland, two from Rumania and nine from the Soviet Union.

2. The technical sessions consisted of concurrent meetings held in the Department of State General Conference Room and the Department of Interior Auditorium. The official languages were English, French, Russian, and Spanish. Simultaneous interpretation was provided.

3. The Symposium and Exposition served admirably to make available to all interested countries the progress, plans, and problems in the field of desalination. The technical sessions covered all phases of the field from the most basic (e. g., the structure of the water molecule) to the operational characteristics of desalting facilities. The frank and free exchange of information by the Soviets was encouraging. The technical sessions were complemented by the Exposition which consisted of a display by industry, government laboratories, and universities of desalination units and related instruments, equipment, and materials. With several fairly minor exceptions this was entirely a U. S. operation.

4. Competition is keen among proponents of various techniques for desalination of water (or purification of brackish water) to seize a portion of what appeared to be an impending sizeable financial investment in this endeavor. Also interrelated with the various techniques for water desalination is the factor of power requirement. Nuclear power is assuming a dominating role in connection with

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processes involving desalination by evaporation. The inordinately large heat of vaporization of water of 540 calories per gram requires a source of inexpensive power. Also the economics of techniques depending on evaporation become more attractive the larger the scale of operation. With nuclear power considered competitive with conventional power, the rivalry between desalination techniques evident at the sessions was compounded by the related nuclear power-desalination plant concept. The nuclear power source serves a dual purpose, heat supply for desalination and electric power for general use. Politics seem to play a big role in advancing the use of the dual purpose nuclear reactor.

5. In general, the technical sessions presenting basic research and scientific-engineering developments left one with a hopeful feeling of progress and advancements in desalting technology which should result in greater efficiency and decreased product cost. Nevertheless, no "essentially new technology" was presented. The exhibitors at the Exposition were not optimistic. Equipment manufacturers complained of poor current business and not much in sight. One atomic energy design firm hinted that unless there is more demand, its desalting group, operating at a deficit, may be dissolved. This is reminiscent of the situation in the case of nuclear power in 1955 after the First Geneva Conference for Peaceful Uses of Atomic Energy.

6. The approximately 100 papers presented served admirably as a status report of world-wide progress and plans in the various desalination techniques. This is summarized below.



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a. Distillation processes - This adaptation of nature's system of retrieving water from the sea is by far the most important present operational method for desalination. The multistage distillation process is to be used by the Soviets for their 30-million gallon per day plant at Shevchenko on the Caspian Sea. Remarks by Dr. V. A. Klyachko, head of the Soviet delegation, were to the effect that the USSR plans to build large numbers of distillation units of about one million gallons per day capacity as well as many 3000-6000

- 2 -

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gallons per day mobile units. Scaling and corrosion present the big problems in these distillation installations. Dr. V. B. Chernozubov, of the Moscow Chemical Machine Building Institute, implied that after a three-year research effort the scaling problem was solved for Caspian Sea water by seeding i. e., the addition of inert particles to serve as a nucleus for the deposition of scale-forming compounds. He stated that for each type of water a unique solution to the scaling problem has to be developed.

The use of solar heat for distillation is practical where water prices are high and the climate is warm and sunny. The Soviets have many small water-desalting solar units scattered in areas where these conditions exist.

b. Ion exchange - In this process the dissolved salts are removed by the use of ion exchange resins. This technique is economical only when the salt content is comparatively low, as in brackish water, and for low capacity units. The Soviet delegation head, Klyachko, had about 20 years' experience in ion exchange prior to his involvement for the past five years with water treatment. The ion exchange technique is not used for treating ocean water. However, some research is going on in both the U. S. and USSR to exploit ion exchange for treatment of brackish water. Both countries use this process in the power industry and other industrial applications where the small amount of hardness in regular water is objectionable. With regard to the operation of ion exchange facilities, the U. S. has a resin loss of 3 percent per year compared with a Soviet loss of 20 percent.

c. Electrodialysis - This process uses electricity as the driving force to pass ions through membranes which allow passage of either the anion or cation, in other words, membranes formed of selective ion exchange resins. This technique finds limited use in the desalination of sea water. However, for treatment of brackish waters it finds acceptance. The Soviets produce large quantities of ion exchange membranes for electrodialysis. These membranes, 3 feet x 3 feet x 1/2 millimeter, are similar to a type produced by the U. S. ten years ago. The Soviets have many 10 to 60 thousand gallon per day units in operation. They are now designing 150-250 thousand gallon per day units. The Soviets have developed for their shepherds in the Southeast section of the

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country electrodialysis equipment of relatively small capacity using diesel-generated electricity to convert brackish water. Klyachko stated that the USSR has plans to build thousands of small desalting units of about 2600 gallons per day capacity. These are to be placed in rural locations in southern USSR to serve farms and isolated homes. The Soviet delegation visited the electrodialysis display at the Exposition. They requested considerable information about the operational characteristics of the units.

d. Reverse osmosis - A membrane is used for this process which allows water under pressure to pass, but not salt ions. This technique shows great promise, although not as much work has been done on it as on electrodialysis. Considerable development work is underway by the U. S. on this process where small plants are in successful operation. The nice feature of this process is the relatively low power requirement. Also the material which seems to be best for the membrane, cellulose acetate, is inexpensive. The biggest problem is to attain greater capacity in the reverse osmosis units without appreciable increase in expense. The Soviets showed a great deal of interest in the two exhibits at the Exposition.

e. Freezing - The principle involved in this technique is that ice crystals form from salt water and separate from the brine to provide potable water. The salt concentrates in the liquid phase. The economics of this process favors the small plant. There are two 200,000 gallons per day desalination plants in operation, one in Israel and one in the U. S. The advantages of the freezing process are that it minimizes the problems of corrosion and scale formation and the energy requirement is relatively low. The Soviets are recovering drinking water (reportedly of very poor quality) from naturally formed ice by separating the liquid from the first portions to melt. This is the reverse of the procedure of obtaining pure water from the first ice crystals formed on freezing saline water.

f. Gas hydration - In this process, a chemical reaction separates fresh water from a salt solution by the use of hydrate-forming materials. Propane has shown the greatest

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promise of the materials used to date. The U. S. has been quite active in exploiting the hydrate process on the pilot plant scale. This process looks attractive as far as energy requirements and corrosion problems are concerned. Klyachko of the Soviet delegation said that although they do not believe they have a very practical hydrate process for seawater conversion, the USSR plans to build a pilot plant on the Caspian Sea with a production of six thousand gallons per day.

7. Desalination has progressed to the point that its use to supply water for industrial or community use is feasible under certain conditions. However, treated water for irrigation is a long way off. The cost figure, reduced to dollars per 1,000 gallons of product water, is the way to compare processes. Unfortunately, common bases for arriving at cost figures are not used. This led to a joking remark by Dr. H. Kronberger of the U. K. Atomic Energy Authority that there is more to be gained through cost studies than by research and development. The cost of desalinated water, using U. S. figures, runs about \$1 per thousand gallons for the one million gallon per day Office of Saline Water pilot plants.

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